

**UTILITY PATENT APPLICATION**

**TITLE OF INVENTION**  
**AUTOMATICALLY ADJUSTABLE REAR**  
**SUSPENSION FOR TRIKE**

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BACKGROUND OF THE INVENTION

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3 Field of the Invention

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5 This invention relates to motorized trikes, and in particular to an automatically adjustable rear  
6 suspension for trike.

7

8 Background of the Invention

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10 Motorcycles comprise an important part of our transportation system, and have been around for  
11 over a century. Gottlieb Daimler, a German engineer, is generally credited with inventing and  
12 building the first motorcycle in 1885. He mounted a four-stroke piston engine to a wooden  
13 bicycle frame. Following a few decades of development, the motorcycle became a reliable, useful  
14 vehicle during the early 1900's.

15

16 While today's motorcycles do not differ significantly in appearance from the early models, they do  
17 incorporate important improvements. Modern motorcycles have stronger frames, more powerful  
18 engines and more dependable brakes. Larger, softer seats make riding more comfortable, and  
19 hydraulic springs help lessen road shocks.

20

21 During recent decades, as the disposable income and affinity for comfort of motorcycle  
22 *aficionados* have increased, large touring motorcycles have become popular. These motorcycles  
23 provide unparalleled stability, comfort and power to their riders.

1

2 Still another motorcycle refinement which has gained recent popularity is the three-wheel  
3 conversion of large touring motorcycles. This conversion typically involves installing an  
4 automotive rear end on an existing motorcycle frame, resulting in one front wheel and two rear  
5 drive wheels. This three wheel conversion, also known as a "trike", affords its riders increased  
6 comfort and stability.

7

8 One problem associated with modern trikes is keeping the motorcycle frame at the correct angle  
9 relative to the surface upon which the trike rests. It is important to maintain the motorcycle frame  
10 at the correct angle relative to the surface upon which the trike rests in order to optimize the  
11 handling characteristics and ride comfort of the trike. This problem arises especially when drivers  
12 of different weights occupy the front seat, or when a passenger climbs into the rear seat.  
13 Although front-to-rear leveling arrangements have been taught within the art for conventional  
14 two-wheel motorcycles, Applicant is not aware of the existence of any such systems which are  
15 usable on trikes. Thus, it would be desirable to provide an automatically adjustable rear  
16 suspension for trike which maintains the motorcycle frame at the correct angle relative to the  
17 surface upon which the trike rests.

18

19 Another problem associated with currently available trikes is a phenomenon known as pushback.  
20 Pushback is the reaction of the motorcycle steering wheel to bumps which the rear wheels see.  
21 For example, if the left rear wheel hits a bump, then the front wheel will tend to veer right due to  
22 pushback. Conversely, if the right rear wheel hits a bump, then the front wheel will tend to veer

- 1 left. Thus, it would be desirable to provide an automatically adjustable rear suspension for trike
- 2 which minimizes pushback.

## **SUMMARY OF THE INVENTION**

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3 Accordingly, it is an object of the present invention to provide a an automatically adjustable rear  
4 suspension for trike which maintains the motorcycle frame at the correct angle relative to the  
5 surface upon which the trike rests. Design features allowing this object to be accomplished  
6 include a compressor pneumatically connected to an accumulator, at least one air spring  
7 pneumatically connected to the accumulator through a valve, and a valve pushrod connecting the  
8 valve to an axle. Advantages associated with the accomplishment of this object include  
9 optimization of the handling characteristics and ride comfort of the trike.

10

11 It is another object of the present invention to provide a provide an automatically adjustable rear  
12 suspension for trike which minimizes pushback. Design features allowing this object to be  
13 accomplished include an air spring mounted between a trike frame and an L arm associated with  
14 each rear wheel. Benefits associated with the accomplishment of this object include increased  
15 trike controllability and rider comfort.

BRIEF DESCRIPTION OF THE DRAWINGS

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3 The invention, together with the other objects, features, aspects and advantages thereof will be  
4 more clearly understood from the following in conjunction with the accompanying drawings.

5

6 Three sheets of drawings are provided. Sheet one contains figure 1. Sheet two contains figure 2.

7 Sheet three contains figure 3.

8

9 Figure 1 is a side view of a motorcycle frame with trike frame and trike swing arm attached, upon  
10 which the instant automatically adjustable rear suspension for trike is installed.

11

12 Figure 2 is a top view of a motorcycle frame with trike frame and trike swing arm attached, upon  
13 which the instant automatically adjustable rear suspension for trike is installed.

14

15 Figure 3 is a plan view of a schematic diagram of the instant automatically adjustable rear  
16 suspension for trike.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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3 Referring now to figure 1, we observe a side view of motorcycle frame 2 with trike frame 4 and  
4 trike swing arm 6 attached, upon which the instant automatically adjustable rear suspension is  
5 installed. Trike swing arm 6 is pivotably attached to motorcycle frame 2 at pivot point 8. Thus,  
6 trike swing arm 6 is free to pivot relative to motorcycle frame 2 around pivot point 8 as indicated  
7 by arrow 10. Axle 18 is rigidly attached to trike swing arm 6.

8

9 Referring now also to figure 2, a pair of L arms 12 is rigidly attached to trike swing arm 6. Each  
10 L arm 12 comprises an L arm horizontal member 14 rigidly attached to an L arm vertical member  
11 16. An air spring 24 is sandwiched between each L arm horizontal member 14 and trike frame 4.  
12 The extent to which air springs 24 are inflated determines the angle of motorcycle frame 2 and  
13 trike frame 4 relative to a surface upon which the motorcycle rests, as indicated by arrow 11.

14

15 The extent to which air springs 24 are inflated is determined by valve 20. Valve 20 is a  
16 commercially available height air control valve which is normally closed, and which has two open  
17 positions: one open position inflates air springs 24 through air spring supply line 26, and the  
18 other open position deflates air springs 24 through air spring supply line 26.

19

20 Valve 24 receives its supply of pressurized gas from accumulator 32 through valve supply line 34.  
21 Accumulator 32 is supplied by compressor 30, which runs off the motorcycle electrical system.  
22 Valve 20 is actuated by valve pushrod 22, which measures the distance between trike frame 4 and  
23 trike swing arm 6. The length of valve pushrod 22 is set at the factory, and in effect determines

1 the proper angle of trike frame 4 relative to the surface upon which the motorcycle rests. The  
2 indication and control system of valve 20 provides for a 30 – 35 second delay in actuation, which  
3 prevents road bumps and other temporary inputs from causing valve chatter.

4

5 In the preferred embodiment, gas shock absorber 28 was disposed between trike swing arm 6 and  
6 trike frame 4, in order to provide an optimum suspension.

7

8 Figure 3 is a plan view of a schematic diagram of the instant automatically adjustable rear  
9 suspension. Compressor 30 supplies accumulator 32, which in turn supplies valve 20 through  
10 valve supply line 34. Valve 20 is mechanically connected to axle 18 by means of valve pushrod  
11 22. Valve 20 is pneumatically connected to air springs 24 via air spring supply lines 26.

12

13 In operation, when valve pushrod 22 informs valve 20 that trike frame 4 is too low, the indication  
14 and control system of valve 20 provides for a 30 – 35 second delay in actuation to prevent road  
15 bumps and other temporary inputs from causing valve chatter. Following this anti-chatter delay,  
16 valve 20 directs compressed gas to air springs 24 through air spring supply lines 26, thus inflating  
17 air springs 24 and increasing the height of trike frame 4 above a surface upon which the  
18 motorcycle rests. The action of raising trike frame 4 has the effect of changing the angle of the  
19 motorcycle relative to the surface upon which it rests, because the motorcycle will pivot about its  
20 front wheel.

21

1 When trike frame 4 is at the factory pre-set optimum height (and consequently the angle of the  
2 motorcycle relative to the surface upon which it rests is optimized), valve pushrod 22 directs  
3 valve 20 to cease inflating air springs 24.

4

5 Similarly, when valve pushrod 22 informs valve 20 that trike frame 4 is too high, the indication  
6 and control system of valve 20 provides for a 30 – 35 second delay in actuation to prevent road  
7 bumps and other temporary inputs from causing valve chatter. Following this anti-chatter delay,  
8 valve 20 permits gas to be released from air springs 24 through air spring supply lines 26, thus  
9 deflating air springs 24 and decreasing the height of trike frame 4 above a surface upon which the  
10 motorcycle rests. This action of lowering trike frame 4 has the effect of changing the angle of the  
11 motorcycle relative to the surface upon which it rests, because the motorcycle will pivot about its  
12 front wheel.

13

14 When trike frame 4 is at the factory pre-set optimum height (and consequently the angle of the  
15 motorcycle relative to the surface upon which it rests is optimized}, valve pushrod 22 directs  
16 valve 20 to cease inflating air springs 24.

17

18 In the preferred embodiment, trike frame 4, valve pushrod 22, and trike swing arm 6 (including L  
19 arms 12), were factory metal fabrications. Compressor 30, accumulator 32, valve supply line 34,  
20 valve 20, air spring supply lines 26, air springs 24 and gas shock absorber 28 were commercially  
21 available components.

22

- 1 While a preferred embodiment of the invention has been illustrated herein, it is to be understood
- 2 that changes and variations may be made by those skilled in the art without departing from the
- 3 spirit of the appending claims.

DRAWING ITEM INDEX

1  
2  
3 2 motorcycle frame  
4 4 trike frame  
5 6 trike swing arm  
6 8 pivot point  
7 10 arrow  
8 11 arrow  
9 12 L arm  
10 14 L arm horizontal member  
11 16 L arm vertical member  
12 18 axle  
13 20 valve  
14 22 valve pushrod  
15 24 air spring  
16 26 air spring supply line  
17 28 gas shock absorber  
18 30 compressor  
19 32 accumulator  
20 34 valve supply line